

# **NAVSEA Condition Based Maintenance Plus (CBM+) Initiative**

Ronald Graffius  
SEA 04RM33 Feb, 2012

# NAVSEA CBM+ (WHY)



At NAVSEA, ship maintenance and lifecycle sustainment are critical to the warfare enterprise.

NAVSEA expects to realize the following benefits from CBM implementation:

- Improved Readiness and Availability of Ships
  - Using diagnostics to monitor failure trends we can increase time between failures by fixing the problems before they actually occur increase operational availability of platforms
- Lower Lifecycle Maintenance Costs
  - Diagnostics can extend planned maintenance requirements periodicities
  - Minimize stock supplies for parts
- Achieve Expected Service Life of Ships
  - Foresee or predict potential pending failures to help prevent catastrophic failures on deployment

# CBM+ is NAVSEA Policy



## DoDI 4151.22 CBM+

Capstone policy instruction that drives CBM+ policy for NAVSEA.

## OPNAVINST 4790.16A (CBM Policy)

“This instruction applies to acquisition, logistics, and maintenance activities for all new and legacy programs.... At the core of Navy maintenance, Reliability-Centered Maintenance (RCM), defined in OPNAV 4700.7 provides the principles and rigorous methodology needed to select the appropriate type of maintenance.” “CBM strategy shall be used to determine maintenance decisions...”

## OPNAVINST 4700.7L (Maintenance Policy for US Navy Ships)

“(1) Maintenance procedures and schedules for Navy ships and related equipment are to be developed and performed per the CBM methodology defined in OPNAVINST 4790.16A...The goal is to perform maintenance only when there is objective evidence of actual or predictable failure...This will be determined per COMNAVSEA approved **RCM methodology**...”

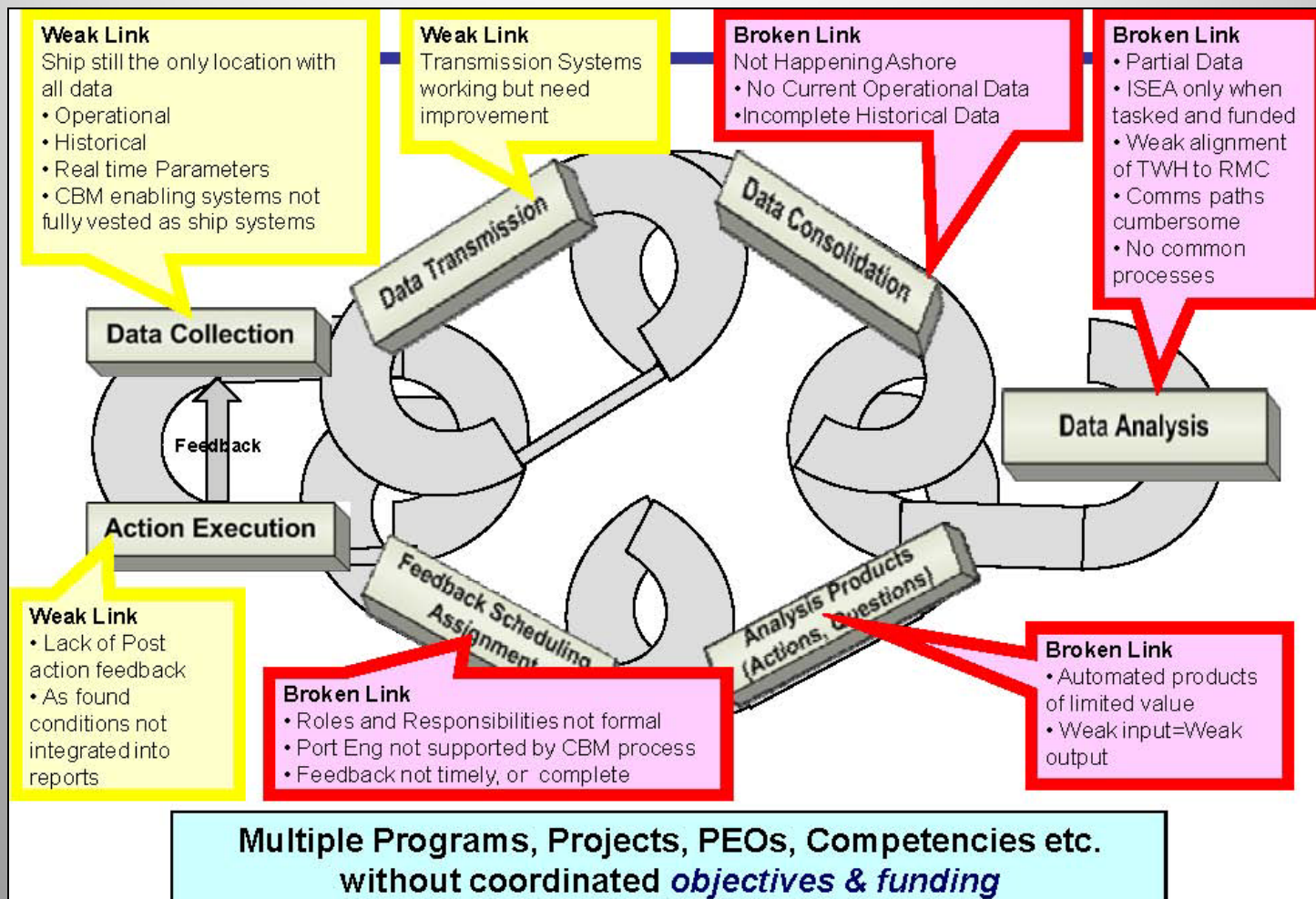
## OPNAVINST 4790.4E (Ships' Maintenance & Materiel Management Policy)

“PMS maintenance procedures will be developed in accordance with **Reliability-Centered Maintenance (RCM)** concepts as specified in MIL-P-24534A and OPNAVINST 4790.16A”

## NAVSEAINST 4790.27 (RCM & CBM Policy for Ships, Ship Systems and Equipment)

Requires that: “...each ship class have a tailored and approved CBM, and RCM-based maintenance program that includes Organizational, Intermediate, and Depot level maintenance requirements, as well as, a NAVSEA-approved CMP that describes Organizational, Intermediate and Depot level planned maintenance actions and maintenance support requirements.”

## CBM as it is Today = Loosely Linked Independent Elements



Source: COMNAVSEASYS COM Diesel End to End Condition Based Maintenance Distance Support Study – June 2010

# NAVSEA (CBM+) Initiative

## Background:

- CBM+ Task Force began meeting in March 2011 (SEA 04)
- Evaluated CBM+ End to End study on Mine Countermeasure ships diesel engines for gaps and action items, and assigned responsibilities (SEA 05)

## Initiatives

- Establishing an Executive Steering Group to provide guidance and authority to CBM+ TF (SEA 04)
- Establishing a CBM+ Knowledge Sharing Network (KSN) (SEA 21)
- Developing NAVSEA Instruction to promulgate CBM+ policy and processes to include Surface Warfare Enterprise Top Level Requirements (SWE TLR) for CBM . (SEA 04)
- Developing CBM+ Implementation tracker and CBM Maturity Model and populate with current fleet data. (NAVSEA CBM Plus Task Force)

# CBM + Task Force

## CBM+ TF organized to support proposed CBM+ ESG

- Chair: SEA 04 (maintenance policy)
- Members:
  - SEA 21 (ships)
  - SEA 05 (engineering)
  - SEA 07 (submarines)
  - NSWC SSES (in-service engineering)
  - NSWC PHD (in-service engineering)
  - PEO LCS (Littoral combat ships)
  - PEO Ships
  - PEO Carriers
  - PEO IWS (combat systems – integrated warfare systems)
  - PEO Subs
  - SUBMEPP (submarine maintenance planning)



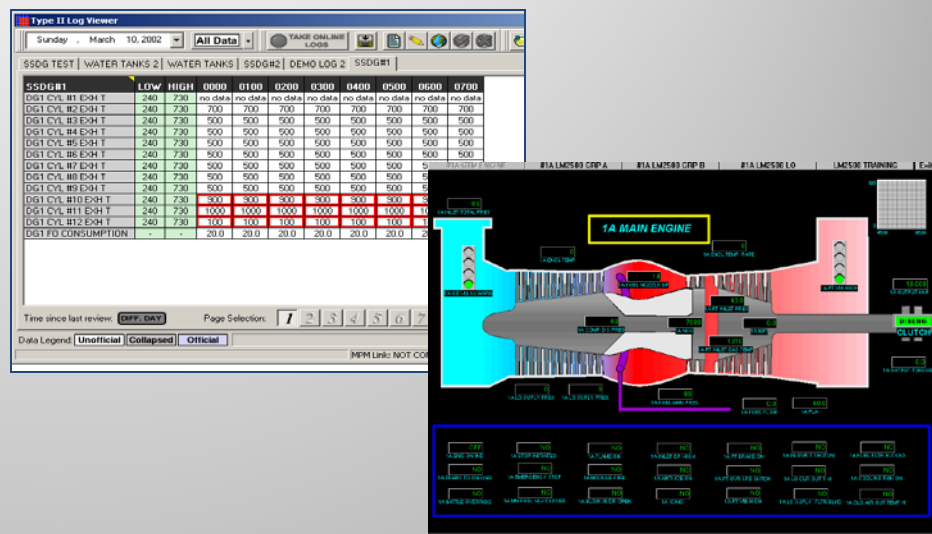
## CBM+ Projects at NAVSEA

- ICAS (Integrated Condition Based Assessment System) – A program of record for CBM data collection, transmission, analysis and feedback.
- LCS Reliability Engineering – Combines CBM with predictive modeling and simulation to better develop prognostic capabilities. Includes hardware to collect data and shore based analysis.
- DEXTER Machinery Health Monitoring System - Provides data collection, diagnostics and prognostics for diesel engines on LSD class vessels.

# ICAS Capabilities - Afloat

- CBM implementation tool
  - Machinery Data Trending
  - Parameter based expert system
  - Vibration Analysis
- Troubleshooting Aid
  - Automated alarms
  - Event capture
- Operational Assessment
  - Material Assessment
  - Plant Situational Awareness
  - Assessment Visit Support (Availability Planning)
- A tool to enable reduced manning
- ILS
  - Access and linkage to PMS, EOSS and IETMs
- Electronic Logsheets

## Data Logging / Situational Awareness



## Continuous Analysis



### ICAS Expert System:

- performs a continuous analysis of machinery data.
- automatically generates maintenance advisory

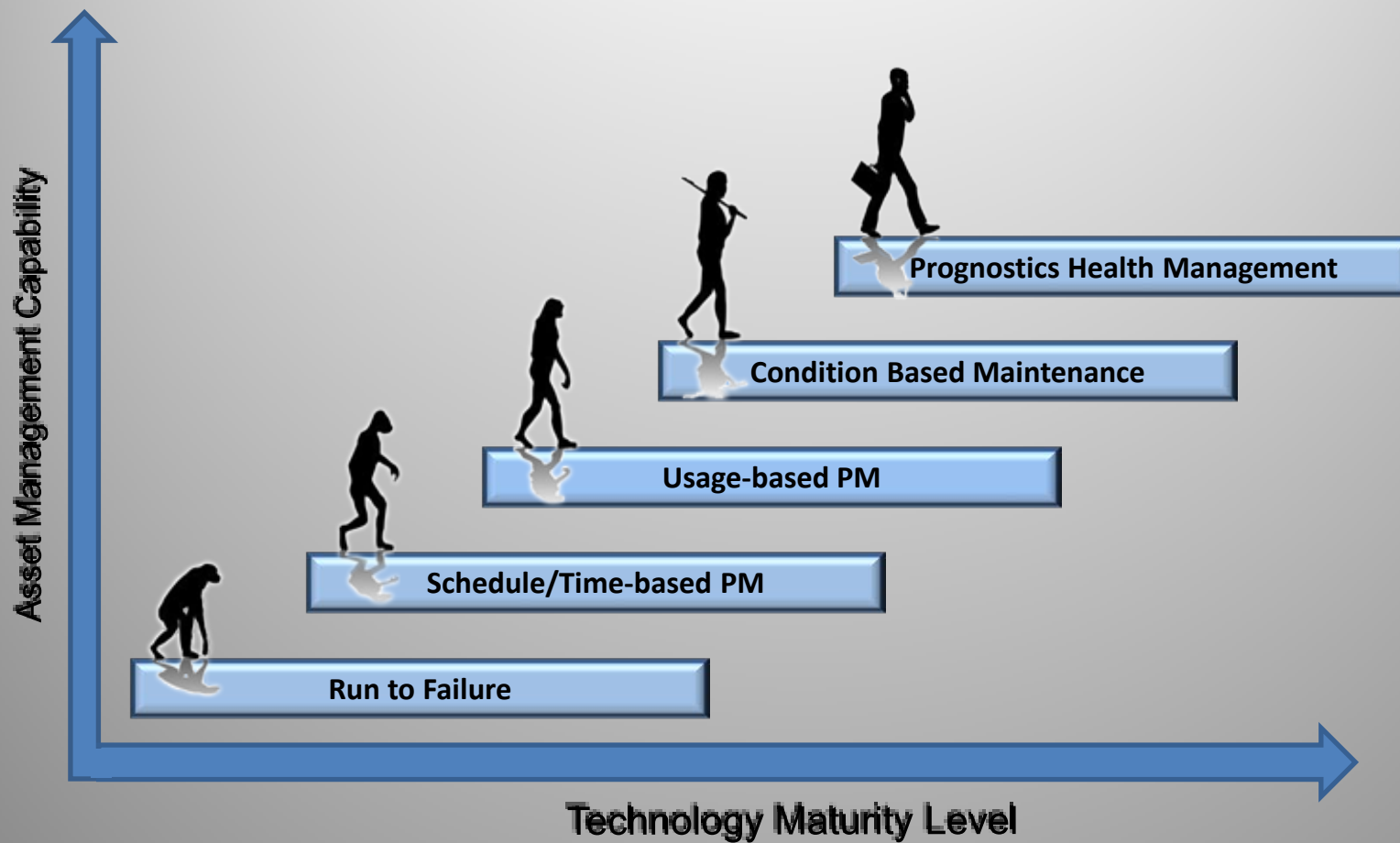


# The Way Forward

- Establish CBM+ Executive Steering Group
- Finish developing CBM+ Implementation tracker and CBM Maturity Model and populate with current fleet data.
- Develop KSN and implement CBM+ E2E Findings
- Coordinate efforts across CBM+ IPTs within NAVSEA Directorates and PEOs (Subs, Ships, and Carriers)

# BACKUP SLIDES

# Evolution of CBM



# NAVSEA RCM Certification & Training Program

*Training is fundamental to success...*

- NAVSEA Policy requires use of RCM in development of all maintenance requirements
- RCM Certification program establishes standards of knowledge and application
  - **Level I** – Basic fundamentals and “Backfit” process
    - Two day course of instruction – also provided at MERs
  - **Level II** – “Classic RCM”
    - One week course of instruction
  - **Level III** – Train the trainer
    - Two week course of instruction for USN employees